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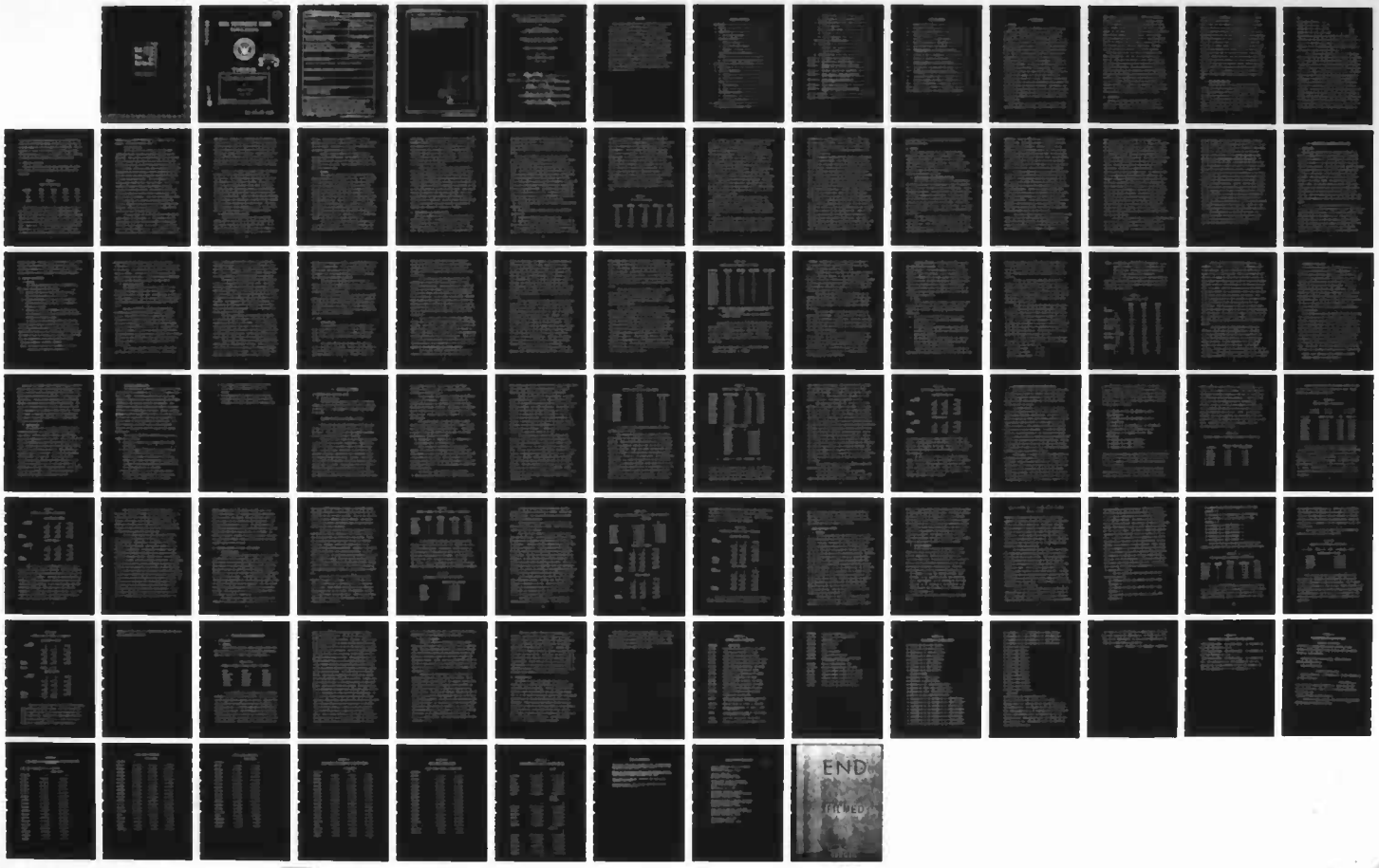

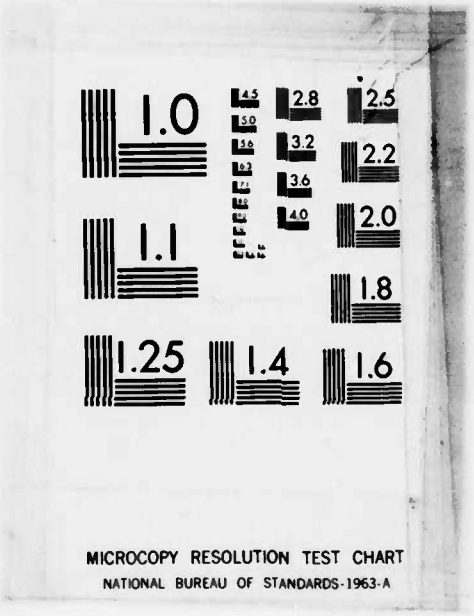
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NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

AN INVESTIGATION INTO ENLISTMENT STANDARDS FOR THE ELECTRONICS TECHNICIAN RATING

by

Rogers A. Bond

June 1983

Thesis Advisor: R. S. Elster

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An Investigation into Enlistment Standards for the Electronics Technician Rating

by

Rogers A. Bond
Commander, United States Navy
B.S., Golden Gate University, 1964

Submitted in partial fulfillment of the requirements for the degree of

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June 1983

Author: Rogers A Bond

Approved by: Richard S. Elster
Thesis Advisor

William E. Rodney
Second Reader

Richard S. Elster
Chairman, Department of Administrative Sciences

Kneale T. Marshall
Dean of Information and Policy Sciences

ABSTRACT

This thesis describes the structure and training pipeline of the Electronics Technician rating in the Navy. Through an analysis of a cohort of 6,309 Electronics Technicians who enlisted between 1 Sept 1976, and 31 Dec 1978, this thesis demonstrates significant differences between personnel who enlisted in Nuclear Field, Advanced Electronics Field and other enlistment programs available during this time period. Through the use of discriminant analysis, three models for predicting potential enlistment success are developed from measures such as the Armed Services Vocational Aptitude subtests, education, age, marital status, enlistment waivers, and months of participation in the Delayed Entry Program administered by the Navy Recruiting Command.

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I. BACKGROUND

A. GENERAL

The basic functions of personnel in the ET rating are performing maintenance and repair on a wide variety of search radar, external communications and navigational equipment for both surface and subsurface systems. Ratings in the Navy are defined as broad career fields for enlisted personnel who require similar qualifications, and perform similar functions generally considered generically classified. The Navy has approximately 84 enlisted ratings, a number which has grown significantly over the years in response to both technological developments and shifts in functional emphases. In general, the Navy is reluctant to establish a new rating for several reasons. Firstly, it is considerably cheaper and easier from an administrative point of view to add a skill to a rating than to develop a completely new rating for a skill. Secondly, ratings tend to develop their own distinct sponsorships which compete for scarce material and personnel resources. For example, the ET rating has spawned the EW (Electronic Warfare Technician) rating as the importance, technological specialization and significant investment in training requirements in the EW field evolved.

Skills within a rating are referred to as NEC's (Navy enlisted classification codes), and are comparable to the

"MOS" found in the other services. NEC's are obtained by individuals generally in two ways: (a) through a formal course of instruction; or (b) through on the job training (OJT). Formal courses of instruction are of three general types: (1) "A" schools, which provide initial skill training after recruit training; (2) "C" schools, which provide advanced instruction generally related to specific systems and (3) "F" schools, which generally provide NEC's in operational areas like Air Intercept Controllers. The vast majority of NEC's are earned at "C" and "F" schools.

ET's have the unique distinction of possessing more NEC's (approximately 200) than any other Navy rating [Ref. 2]. Some NEC's are unique to ET's, while others are shared with such diverse ratings as Machinist's Mates and Cryptologic technicians. The proliferation of NEC's is an accurate reflection of the incredible growth of technology over the last two decades, contrasted against the lifecycle of Navy systems. Systems built twenty years ago are still active and require technical expertise to maintain them. However, the Navy may install a new system on a ship which requires one or more additional NEC's, either from the same ET or by adding an additional ET billet to the unit.

B. RECRUITING

In order to develop sufficient numbers of qualified personnel for each rating and NEC the Navy develops an "input plan". Input plans for "C" schools, which produce

the majority of Navy NEC's, are developed by OP-11 through the use of a manpower model called "CISTIRS"; the model assumes each NEC must achieve desired manning levels within the year following the plan's execution. OP-135, the enlisted strength planners, develops the input plan to "A" schools and tasks the Navy Recruiting Command with producing the required numbers and types of personnel required by the plan. For prospective ET's- all new recruits (with the exception of a small number of reservists in the Active and Ready Mariner Programs) are brought into the Navy through the Nuclear Field (NF) or Advanced Electronic Field (AEF) programs. Additional ET's are obtained through fleet inputs into the ET rating by personnel who obtain requisite fleet experience (OJT) and who complete certain specific requirements to successfully pass an ET advancement in rate examination. Approximately fifteen percent become ET's in this manner; of these, approximately half achieve a specific ET NEC.

1. NF and AEF Programs

Basic qualifications for entry into the NF/AEF programs are determined largely through the application of scores attained in certain subtests of the Armed Services Vocational Aptitude Battery (ASVAB) subtests. For NF candidates, a special Nuclear Field Qualification Test (NFQT) is administered by the local recruiting district to further define eligibility. The following illustrates basic eligibility for the two programs:

NF	AEF
ASVAB (WK + AR) = 115 and	N/A
ASVAB (WK + MC + SI) = 140 and	N/A
ASVAB (MK + EI + GS) = 156 and	SAME
ASVAB (MK + EI + GS + AR) = 218	SAME

Even though an applicant has passed all the criteria for entrance into the NF program, he must achieve a score of at least 51 on the NFQT (waivers may be granted to no lower than 48), or he is then processed into the AEF program, if he is still willing to enlist [Ref. 3].

The terms of enlistment for both NF and AEF enlistees are essentially the same. Recruits enlist for a period of four years with a "conditional" extension for an additional two. While it is generally believed that the extension is conditional upon obtaining advanced skill training ("C" school), this is technically not the case. The extension, which may or may not be implemented at the Navy's discretion, is conditioned on the recruit's entrance into the Navy at paygrade E-3 and his acceptance of automatic advancement to E-4 at the completion of his "A" school training. It should be noted here that the vast majority of NF/AEF accessions do in fact continue training through "C" school, and do have their extensions activated resulting in a total six year active duty first enlistment. Two other facets of these programs deserve mention. First, no rating is guaranteed under either NF/AEF program. Secondly, as

will be more thoroughly discussed in the training section, there is a considerable amount of mobility between the two programs after the training pipeline is commenced. This is primarily a result of the tremendous pressure to obtain nuclear qualified technicians, considered the most difficult to recruit and have complete the requisite training.

C. TRAINING PIPELINES

Table I illustrates the ET input programmed for Basic Electronics and Electricity School for the fiscal years 1982-1985.

TABLE I

BE&E ET Input Plans

Program	FY82	FY83	FY84	FY85
NF	1106	1270	1420	1345
AEF	2479	2831	2700	2652
Other	75	80	295	326

The ET training pipeline is one of the most complex in the Navy. Both NF/AEF recruits spend approximately seven and one half weeks at one of three Recruit Training Commands (RTC's) at Orlando, Fla; Great Lakes, Il; or San Diego, Ca. There are five distinct training pipelines after RTC completion. These are: (1) the Nuclear Field (both surface and subsurface); (2) the AEF ET (Conventional surface); and (3) three AEF ET programs leading to training in Strategic

Weapons Systems (SWS); Submariner, (Navigation); and Submariner, (Electronic Warfare) [Ref. 1].

1. Nuclear Field ET

All NF and AEF ET's, except for the AEF (SWS), attend BE&E school located at the same training site as their RTC. This course is attended concurrently by approximately 13 ratings other than ET's, but ET's are the only trainees who take all of the 34 separate training modules in the curriculum. There is a good deal of competition between representatives from different warfare communities and sponsors for inputs into their respective advanced ET training pipelines during BE&E school. In this competition, the nuclear power community has a distinct edge. In view of the unusually stringent entrance requirements, perceived scarcity of qualified entrants, and length of training, a trainee who desires to enter nuclear training will, if he meets all the requirements. This does not necessarily apply to other programs, and reflects the exceptionally high priority, probably justifiable, given to the nuclear power community. BE&E lasts for approximately 13 weeks and has an attrition rate of approximately 10%.

Following BE&E, the NF ET will attend a specific "A" school course at Great Lakes, Il. This course, lasting approximately 21 weeks, covers more advanced electronics (9.6 wks.), nuclear theory (5 wks) and 6 weeks of instruction in the SPS-10 radar system. Upon satisfactory completion of this course, the NF-ET is automatically promoted to

paygrade E-4. However, as a byproduct of the emphasis on safeguards in the Navy's nuclear power program, the bottom one-third of the NF-ET "A" school graduates are eliminated from the nuclear training pipeline and rerouted into the conventional surface AEF-ET pipeline. These personnel will attend the communications and AN/SPA-25 portions of the normal AEF-ET pipeline (the only subjects they do not cover in the NF-ET "A" school), and become conventional surface ET's.

Following "A" school completion, the NF designated ET attends the Nuclear Power Fundamentals Course in Orlando, Fla. The trainee spends from three to six weeks here depending on his score in the NFQT. After this, he attends the full Nuclear Power Course (NPC) in Orlando. Following the NPC, the trainee attends a 26 week Nuclear Propulsion Plant Operators (NPPO) course in either Idaho, New York or Connecticut. Here, the NF-ET receives training in the operation and maintenance of reactor control systems for both nuclear submarines and surface ships. The total training pipeline length <u>exclusive</u> of leave, transit, holidays or any other delays, is approximately 22 months.

2. <u>AEF-Conventional Surface</u>

After attending BE&E school, the conventional surface AEF-ET attends AEF ET "A" school at Great Lakes. This school consists of three separate modules: (1) 9.6 weeks of advanced electronics; (2) 9 weeks of communications; and (3) 9.5 weeks of radar systems (SPS-10 and

SPA-25). The trainee is then promoted to E-4 and will generally proceed to advanced training on a specific system at a "C" school. His total training time is approximately 12 months, again exclusive of any delays.

Should a trainee complete "A" school at only a marginal level of performance, the Commanding Officer may recommend that he not receive "C" school training and send him directly to the fleet. This is decidedly, however, the exception--not the rule.

3. Summary

With pipeline lengths of ten to twenty-two months, survival becomes a matter of great concern. An examination of "cumulative survivor" rates was made for each pipeline. This was calculated by applying the known or estimated attrition rate for each training block in the respective pipelines on a sample group, and then deriving an overall survival rate. For the nuclear pipeline, the survivor rate was approximately 45%. The correct interpretation of this is that of 100 enlistees who enter the RTC in the nuclear field program, 45 will become qualified nuclear technicians. The survivor rate did not take into account the mobility of trainees between pipelines. The survivor rate for AEF was roughly 52%, and 60% for the AEF (SWS) trainees.

"Attrition" in the Navy is normally thought of as a total loss to the service. In the Training Command, however, attrition applies only to the applicable course of

instruction. As discussed previously, there is considerable movement between these pipelines. E.g., the "bottom third" rule applied in ET NF "A" school significantly increases its attrition rate, but, as these personnel reenter the AEF pipeline, they are not a loss to the Navy. This tends to inflate attrition rates in the NF pipeline. Historically, ET attrition out of the Navy is quite low (less than 10%) over the entire first enlistment.

There is little doubt that these low cumulative survivor rates attest to the difficulty, length and sensitive programs contained in the various ET pipelines. Few areas are more sensitive than nuclear power and strategic weapons systems; accordingly, the emphasis on safeguards and a higher degree of technical competence is justified in view of the unacceptability of risk in these areas. And, regardless of the length of the training pipelines, with a six year enlistment the Navy probably gets considerably more fleet use from a "qualified" technician from the ET pipeline than from the typical four year enlistee who attends a shorter, less technically intensive "A" school.

D. REQUIREMENTS AND AUTHORIZATIONS

The Navy's demand for trained ET's, as well as for any other required skill, is determined largely through three directorates on the staff of the Deputy Chief of Naval Operations (Manpower, Personnel & Training) OP-01. These are: (a) the Directors for Total Force Planning (OP-11);

(b) Total force Programming (OP-12); and (c) Military Personnel Policy (OP-13). It is perhaps easiest to understand the general methodology and approach to determining demand for specific ratings and skills in the following manner.

Through various devices such as ship and squadron manning documents, OP-11 compiles lists of specific, identifiable "requirements" projections by rate (paygrade and rating) and specific NECs over approximately the next ten years. OP-11 coordinates extensively with CNET in order to ensure that the necessary training facilities and curricula will be established to meet the projected requirements. OP-12, whose primary concern is with programming Navy requirements into the Department of Defense Planning, Programming and Budgeting System (PPBS), translates these requirements into "Authorizations" or billets. A host of considerations enter into this conversion from requirements to authorizations including but not limited to the following:

(1) Congressionally mandated end strength limitations and paygrade ceilings.

(2) Desired sea-shore rotation pattern for the applicable rating.

(3) Promotion opportunity within the rating.

(4) General duty and non-rating specific billet requirements (such as recruiters, recruit company commanders, etc.).

As a general rule, billet authorizations exceed requirements by a significant number in order to produce a sufficient

inventory of qualified skills. Ultimately, the Navy's enlisted distribution system addresses billet authorizations on a fair share basis in the assignment of personnel (not requirements). OP-13 provides the following functions pertinent to this process: (a) The Enlisted Community Manager (ECM) is responsible for monitoring the health and overall manning of a rating and its NECs; and (b) the Enlisted Strength Planners are responsible for developing an "A" school plan (in conjunction with CNET) and for determining (and tasking the Navy Recruiting Command to access) the numbers of personnel necessary to enter each training pipeline in the Navy to meet total authorizations.

Table II illustrates the FY 1983 requirements, authorizations and inventory of ETs at the beginning of the fiscal year.

TABLE II

ET Rating Structure

Paygrade	Reqmts	Authoriz.	Inventory	Diff
E-9	101	173	133	- 40
E-8	251	463	405	- 58
E-7	550	1448	1347	- 101
E-6	948	3679	3097	- 582
E-5	1197	4889	5953	+1064
E-4	3035	4399	5722	+1323
TOTAL	6082	15051	16657	+1606

A close look at the composition of requirements, authorizations and inventory reveals a fundamental dilemma faced by managers of the ET rating--specifically, a "domino effect" on authorizations generated by the paygrade structure of the requirements. Fully 50% of ET requirements are for junior technicians, i.e., E-4 and below. However, the accelerated advancement features of the NF and AEF enlistment programs virtually guarantee that an ET will not hit the fleet until he is at paygrade E-5. The dilemma faced by both OP-12 and OP-13 is to match these junior first term requirements with a billet structure that will still provide "junior" technicians to fill these requirements. Contrary to the current facts in operation, requirements are written as if the ET rating was characterized by four year enlistees who enter the service at paygrade E-1 and advance in a more traditional, slower manner.

Requirements drop off sharply at the E-5 level, reflecting less need for the first supervisory level. The requirements structure then follows the traditional gradual pyramid on up to the E-9 level, reflecting a need for higher reenlistment rates as personnel gradually commit themselves to a career.

However, over 90% of AEF/NF ET enlistees attain paygrade E-4 within 9 months of total active service. They have an excellent opportunity to advance to E-5 within two years of total active service, which leads to a further opportunity

to advance to E-6 before the end of their six year total active service obligation. If first term ET's are facing the first reenlistment decision at the E-6 level, neither the requirements nor the authorizations structure offers much upward mobility.

It is somewhat paradoxical that the policy initiated to attract NF/AEF enlistees, (e.g., accelerated advancement, and excellent technical training in exchange for six years of active duty), serves also as a disincentive for reenlistment. Accelerated advancement additionally aggravates a major problem in highly technical ratings like the ET community. The Navy ends up promoting these personnel out of technical positions into supervisory positions very rapidly. As a result, inexperienced personnel tend to be assigned to billets requiring experience. Further, should an ET prefer performing as a technician, there will be only limited opportunity for him to do this beyond his first enlistment.

Another major problem experienced by the rating manager is skill NEC proliferation and matching. This is not only a problem for billet writers, as equipment suites are upgraded and added to units, but for the ECM as well. Some ET NECs require the acquisition of other NECs as prerequisites or utilize them for their entire source input. The complex problem of matching NECs is significantly exacerbated by the relative mobility available to ETs in their training pipeline. This causes significant problems for both ECM and

enlisted detailers in both planning and distribution of qualified personnel.

E. SUMMARY

The preceding overview of the ET rating has been designed to give the reader a general idea of the size, complexity and caliber of personnel in the ET rating before describing the actual analysis. This should assist the reader in understanding some of the methodology and insight employed by the author in establishing various criteria for performance assessment.

1. Some Problems and Proposed Solutions

Provided that another rating is not developed from its present structure (a nuclear power rating, for example), the ET rating will continue to grow in future years. From a management standpoint, the proliferation of NEC requirements is extremely complex and inefficient. A possible improvement to this may be in recognizing the generic classification of training and qualifications of rated ETs. These groups may be roughly categorized as: (a) Nuclear Power; (b) Strategic Weapons Systems; (c) Radar & EW; and (d) Communications/ Navigation.

The Navy essentially recognizes certain categories, like nuclear power, through a system referred to as "closed Loop Detailing". This system treats NF qualified ETs as a separate group by rotating them only to NF specified billets and maintaining a separate ECM for the entire enlisted NF

community. The Navy used to maintain three rating categories of ETs. These were called ETR, ETN and ET (radar, communications and general). Decidedly short term in nature, the ETR/ETN experiment proved too restrictive and essentially meaningless because both ETRs and ETNs merged into the parent ET rating at the E-6 level, and did nothing to establish generic groups beyond the first enlistment. Generic classifications would be useful only if one takes a long term, structural view of billets and requirements.

The author suggests that the Navy would significantly benefit by focusing on generic classifications of skills. I submit it is considerably easier and takes less time to train a qualified radar technician in a new radar system, then training an ET whose sole experience has been in communications equipment. Except for closed loop NECs, the entire enlisted distribution system does not have an effective tactic or methodology to take advantage of specific past qualifications. If the timing is right (strictly coincidental), the detailers will take into account personnel experience and qualifications; but there is no requirement, other than common sense, for him to do so.

The author suggests the most significant problem the Navy faces, in this and other ratings whose sources are six year active duty obligor programs, is the reconciliation between long term requirements and short term policies of recruitment, compensation and advancement. An identical "strategy"

applied to each rating generates its own problems, as demonstrated by the ET rating structure. Here, requirements and authorizations are biased at the technician and junior enlisted paygrades, reflecting the relatively small numbers of supervisors needed. This applies to Boatswain Mates as well as Nuclear Qualified personnel. The short term policies to meet this broad objective in six year enlistee programs, however, is biased in favor of supervisors, not junior technicians. The ET who is ambitious has very limited options at the first reenlistment point: (a) reenlist and shift his emphasis toward supervisorial objectives; (b) attempt to become a commissioned or warrant officer (which would seem a preferable alternative if he recognizes the shift from "technician" to "supervisor"); or (c) separate into a civilian enviornment in which his skills and qualifications are greatly in demand. To counter this, the Navy uses money in the form of Selective Reenlistment Bonuses (SRB) which can reach $20,000 for nuclear qualified personnel, and which, until recently had the psychological impact of a lump sum payment. Such costly expedients, of course, do nothing to cure the basic structural and strategic flaw in the system.

The author proposes that the accelerated advancement options of the six year enlistee programs be eliminated, and replaced instead with cash bonuses at significant points in the trainee's pipeline. An examination of differences in

total basic pay, earned over a six year period, indicates that a difference of approximately $4,000 is paid to the six year enlistee who takes advantage of accelerated advancement opportunity. This would suggest that we are obviously willing to pay these personnel; but why pay them at the expense of the organization's structure and purpose? If the requirement for at least a six year active duty obligation is necessary to recoup the significant training investment in ETs and other technical ratings, a schedule of bonus payments keyed to significant milestones in the training pipelines, applicable to initial six year obligors only, would provide incentive value similar to the existing accelerated advancement policies. However, the six year obligor would tend to enter the fleet as a junior E-4 petty officer and the opportunity to evaluate and employ him as a technician is maximized. At the end of his first enlistment, he would tend to be looking ahead at advancement to E-6, a perspective which is significantly different from the limited advancement opportunity to E-7 and above. Above all, the Navy would benefit from having more experienced supervisors.

While experiments of this kind are risky, the currently favorable recruiting and reenlistment climate provide a unique opportunity to minimize this risk and provide some significant long term benefits.

II. INTRODUCTION TO COHORT INVESTIGATION

A. BACKGROUND

The original purpose of this research effort was to develop a model which could be applied by the Recruiting and Training Commands and Navy planners, as a measure of potential success of the applicant or untried trainee in the ET rating pipeline. To accomplish this, access to several data bases comprising a cohort of 206,229 accessions who enlisted in the period 1 Sept 76 through 31 Dec 78, was provided. The data bases were originated by the Defense Manpower Data Center (DMDC), the Naval Health Research Center (NHRC) and the Navy Examining Center. Data bases from these three sources were compiled and condensed into one data set of 238 variables for the entire cohort of 206,229. The set contained entries through Sept 1982, from DMDC and the Examining Center and through April 1982, from NHRC.

It should be noted that the period 9/1/76-12/31/78 was a uniquely difficult one for manpower managers. The Navy met its major recruiting goals in only one month, December 1976, the final month of enlistment for G.I. Bill eligibility. Retention, both first term and career, dipped to unacceptably low levels while operational fleet commitments in the Indian Ocean significantly increased. In the face of rising, double digit inflation the services experienced

several pay caps. Further, it was discovered that the ASVAB subtests had been misnormed resulting in the accession of significant numbers of unqualified recruits. All in all, it was an extremely bleak environment for manpower managers.

B. ANALYTIC METHODOLOGY

1. General

The general methodology chosen to accomplish the purpose of the research was as follows:

(a) Identify recruits and other trainees entering the ET training pipeline in the cohort.

(b) Develop meaningful criteria from the available data base which could be applied as a measure of success or failure.

(c) Identify or develop independent variables within the data base which would be accessible and readily available to potential users.

On recognizing the different qualifications for the NF and AEF programs, as well as the proliferation of programs and guarantees made available to the Recruiting Command during this period, a working cohort of 6309 actual and potential ET's was excised from the original data base. This was accomplished using the following variables:

DMDCRATE, EXAMRATE, RECPRGSC, RCPGSCRT

NOTE: the definitions for all variables used in the analysis are contained in Appendix A.

These variables were keyed to both recruiting program intentions in the ET rating as well as the actual attainment of an ET rate. The name given this data set of 6309 observations is "ETALL". In view of the OP-135 input plans and poor recruiting environment, this number seemed a reasonable estimate for the slightly more than two year period.

2. Analytical Vehicle

The primary analytical vehicle available was the Statistical Analysis System (SAS) installed at the Naval Postgraduate School January 1982. The data base is formatted in SAS language which, once the idiosyncracies of SAS formats are overcome, proves to be a versatile, powerful analytical tool.

The SAS Discriminant Analysis procedure (PROC DISCRIM) was selected as the primary specific analytical method. This employs a measure of generalized squared distance to a classification criterion, in this model a criterion of successful or unsuccessful enlistment, based upon a pooled covariance matrix [Ref. 4]. To determine the final independent variables to be entered in PROC DISCRIM, SAS has available a stepwise feature (STEPDISC) which selects variables for the prospective model utilizing F statistics meeting a preselected entry significance criterion (.10 in this case).

The Stepdisc procedure computes both total sample and within class or category correlations. Correlations

serve two useful purposes here. First, they provide an indication of both the direction and the degree two variables relate to each other. Secondly, they provide a vehicle for confirming and sometimes assisting logical thought and intuition regarding a relationship between two variables.

For example, the variables CHYEC and ENTRYAGE have a positive correlation with a value of .5368. One would intuitively expect age and educational achievement to be positively correlated (i.e., the older one is the more education he is likely to have), but one might expect this relationship to be a bit stronger than that indicated by a value of .5368. The strength of this correlation, however, is affected by the fact that 80% of enlistees have a single level of educational achievement (12 years), but they have an age spread of 17-20 years.

The main significance of correlations as applied in this analysis was with regard to selection of the final variables to be entered in the model. If two variables are highly correlated with each other, and one was significant in terms of entry into the model, one would expect the other to have similar significance. If both were entered in the model, however, a high degree of collinearity might result.

SAS also has the capability to apply General Linear Models (GLM) to classification criteria. This procedure was utilized to check on the results of the Stepdisc procedure with the aid of student t values. If an independent variable was included by the Stepdisc procedure, but was

insignificant in terms of t value, it was discarded from the final Discriminant model. This, of course, tends to reduce the r square (the proportion of variance accounted for by the model); but it provides better distinction and meaning for the model's independent variables.

The purpose of the model was not to maximize r square, but to give the field user a better idea of which individual characteristics of potential recruits mean more to the recruit's eventual success.

A final vehicle for testing the model was a program developed by Dr. William McGarvey within the SAS framework, to generate two random samples from the observations used to develop the model; one sample (2/3 of the observations) was used to calibrate model parameters, while the other was used to validate the model parameters.

C. DATA

1. Data Problems

Initial examination of the cohort disclosed some major deficiencies in the data set, both in terms of variables selected from the original DMDC, NHRC and Examining Center files, as well as the occurrence of "impossible" values.

Each ASVAB subtest, for example, has a maximum number of questions and scores. However, a large number of scores exceeding the maximum attainable value of each subtest was recorded in the data set. Further, recognizing

that we are examining mostly Mental Group categories I and II in NF and AEF accessions, it appears unreasonable to accept ASVAB scores of zero; yet a large number of obiously inaccurate scores were recorded at the lower end of the scale.

An examination of the variable "Entrpayg" (the paygrade of a recruit when first entering active duty) produced some difficulty. Despite enlisting in the NF/AEF program, in which the recruit is enlisted at paygrade E-3, a significant number were reflected as entering paygrade E-1 in the data set. In all cases, the variables "NDAYSE2" were checked as being zero, indicating that a mistake had been made either in recording the entry paygrade, or quite possibly in the actual enlistment. Unfortunately, there is no way to check the source or reason for this error from the data set.

It was further noted that a significant number of nuclear trained ET's emanated from AEF and other enlistment programs. Yet, because the recruit program under which the member originally enlisted was not updated or changed in any file, only those AEF or other enlistees who successfully completed nulcear training could be extracted. There is no way to extract those enlistees (non-NF) who entered the NF training pipeline after commencing the RTC or BE&E, and who failed or were dropped from the nuclear program.

The variable "NDAYSE4" created some problems of interpretation because it did not take into account the

effect of demotions. For example, if a cohort member was advanced to E-4 after 180 days, remained an E-4 until demoted after an additional 180 days (360 total) and was advanced again to E-4 after an additional 180 days (total 540), the value of "NDAYSE4" assigned in the data set is 540. Obviously the further along in enlistment a demotion occurred, the higher the value assigned the variables. This methodology also applied to demotions from E-5 to E-4; accordingly, if one wishes to test the time of advancement to E-4 by NF/AEF enlistees, a bit of caution needs to be exercised.

Similar interpretive problems occur in the variable "ATTRITCD". This variable is assigned three values indicating the enlistee was: (a) on active duty (0), (b) discharged honorably from active duty (1), and (c) discharged for some reason of unsuitability (2). However, it was discovered that some deserters (presumably those still on the loose) carried a value of "0" for "ATTRITCD". While this is consistent with the "limbo" status of their enlistment, it elicits the point that certain variables necessitate matching and coordination with other variables to extract a correct interpretation. ATTRITCD, for example, can be compared to a variable that indicates enlistment status which contains an indication of desertion.

On discovering the peculiarities of ATTRITCD the variable ISC3 (Interservice Separation Code), was found to

have values which could be meaningfully clustered to give more accurate indications of favorable or unfavorable separations. For example, deaths could now be entirely deleted from the analysis. Accordingly, the variable "SEPCD" was created with the following values: (a) 0 meaning on active duty; (b) 1 meaning a discharge under honorable conditions; (c) 2 meaning disciplinary or unfavorable discharges (attritions).

Table III illustrates the effect of unreasonable values assigned to certain variables in the data set. Rather than exclude the observation from the data set, only the specifically affected variable was assigned as a missing value in SAS processing.

The data set also lacks certain variables which could provide quantum improvements in this and other analyses. This was caused, primarily by a lack of foresight and "environmental awareness" on the part of the author and others. Specifically, the scope of the enlisted accelerated advancement programs developed during this difficult manpower period, has resulted in paygrade E-5 attainment being a much more meaningful criterion measure of success or achievement than E-4. Unfortunately, data on "NDAYSE5" or data on E-5 advancements was not requested from DMDC or the Examining Center. This proved particularly disadvantageous in analyzing ETs, virtually all of whom make E-5 fairly early in their six year enlistment.

TABLE III

Missing Values Generated--N = 6390

VARIABLE	MISSING	PERCENT	LOW-VALUE	MAX VALUE
ASVAB(GI)	297	4.6	6	15
ASVAB(NO)	366	5.7	22	50
ASVAB(AD)	261	4.1	7	30
ASVAB(WK)*	621	9.7	19	30
ASVAB(AR)*	789	12.3	14	20
ASVAP(SP)	316	4.8	7	20
ASVAB(MK)*	927	14.5	14	20
ASVAB(EI)*	297	4.6	15	30
ASVAB(MC)*	300	4.7	7	20
ASVAB(GS)*	341	5.3	10	20
ASVAB(SI)*	398	6.2	8	20
ASVAB(AI)	438	6.9	6	20

NOTE: (a) The criterion for determining Low Value cut off scores was the highest value containing ten or more observations.

(b) * refers to those subtests used to determine NF/AEF eligiblity.

The eligibility to enlist with full educational G.I. Bill benefits expired 31 December 1976. As significant as this date is to manpower analysts, there was no specific indication of eligibility in the data set. Accordingly, the variable "SIGNUP" was developed applying the following methodology:

((ACTIVE DUTY START YEAR * 100) + ACTIVE DUTY START MONTH) minus MNTHSDEP = "SIGNUP"

EXAMPLE: A member who entered active duty in August 77 who had spent 9 months in the Delayed Entry Program (DEP), would have a SIGNUP variable value of 7699.

A SIGNUP value of less than 7700 was almost assuredly G.I. Bill eligible; however, in view of the large cluster of values (8%) with a SIGNUP of 7700, and knowing that December 76 was the only month recruiting quotas were attained, those with a SIGNUP of less than or equal to 7700 were considered eligible for analytical purposes.

Values for certain variables like NDAYSE4 were so numerous and disparate that they were grouped together into more meaningful clusters under the variable name "MNTHSE4" which corresponds roughly to the original value converted to months.

The variable HYEC was coded to specific levels of educational achievement. This was converted to "CHYEC", a more literal indication of grade level. Those who completed less than eight years of education were assigned a value of 3.5; those with GED equivalencies, 11.5, to distinguish them from high school graduates.

The variable NDPNDNT1 was assigned values from 0-8 in the data set. As the desire in the analysis was to check on the effect of parental responsibilities, this variable was converted to the variable DEPEND which was assigned values as follows: (a) 0 meaning single; (b) 1 meaning married with no other dependents; (c) 2 meaning married with more than one other dependent.

Numerous changes to variable values were effected for administrative purposes. These included assigning missing values ('.' in the SAS system) to variables with values of "9999" like NDAYSE2, 3 or 4; assignment of the artificial DMDCNEC 0001 for NECs greater than 3389 (nuclear qualified cut-off) and NECs indicated by alphanumeric characters; and assigning correct values to MRTSTAT1 which contained both zero's and 1 to indicate single status. A composite listing of these adjustments to variable values is contained in Appendix B.

2. Bias

As the investigation proceeded, it was evident that the subject of bias, not solely in the statistical sense, needed to be explored. Three major concerns surfaced immediately.

(1) The inability to account for all entrants into the NF program, not just those who successfully completed training.

(2) The differences in advancement opportunity between six year enlistees (NF/AEF) and those who enlisted under other programs.

(c) The non-availability of NFQT scores, i.e., the "in house" test administered to applicants qualified for NF by their ASVAB subtest scores.

Concern (1) was elicited because the inclusion of only successful nuclear qualified ETs from the AEF and other

enlistment programs, meant that they would be compared only to the NF enlistees who failed to complete the training. In view of the "bottom third" rule applied at NF-ET "A" school, this approach would have significantly biased the analysis.

Concern (2) meant that the same criterion for success, in terms of advancement achievement, could not be applied to NF/AEF enlistees as to the "other" cohort group. Advancing to paygrade E-5 without benefit of formal training or accelerated advancement opportunities after entering the Navy at E-1, is not equivalent to making E-5 after after "automatic" promotion to E-4.

Concern (3) introduced the specter of 'motivation'. If an applicant desired the NF program, passed the ASVAB criteria but then failed to NFQT, would he be more likely to opt for nuclear training after he entered active duty or not? In the recruiting environment of the period, NF enlistees were the number one priority in enlisted programs. This "selling pressure" has a tendency to create reactions which are worth considering. Availability of NFQT scores might have provided some insight into this.

As a result of the foregoing, a decision was made to divide the cohort of 6390 enlistees (ETALL) into three distinct groups for the analysis:

NF enlistees (ETNF)	N = 1854
AEF enlistees (ETAEF)	N = 3354
OTHER enlistees (ETOTH)	N = 1101

NOTE: 81 observations representing enlistees who actually ended up in other ratings were dropped from the cohort groups. The program used to accomplish the division is contained in Appendix C.

Table IV illustrates the general characteristics of each cohort group to give the reader an idea of the caliber of personnel in this rating before discussing the criteria developed for the analysis.

TABLE IV

Characteristics of ETs

	ETNF	ETAEF	ETOTH
N	1854	3354	1101
MNTLGRP: I	29%	11%	16%
II	67%	67%	61%
III	4%	20%	16%
EDUC GE 12 yrs.	97%	90%	85%
GI Bill Elig	21%	31%	53%
ENTRYAGE LE 18	49%	52%	52%
ENTRPAYG: E-1	2%	1.6%	53.9%
E-3	98%	98%	38%
MRTSTAT1 (married)	35%	39%	34%
HYPAYGRD: E-4	30%	29%	41%
E-5	67%	64%	41%
E-6	3%	1.5%	6%
NOTRCMD EQ 1	7%	10%	9%
SEPCD EQ 0	84%	79%	41%
1	9%	12.4%	53%
2	6%	9%	7%

Several interesting observations regarding these summary statistics should be noted before commencing the actual analysis. Firstly, over 50% of the ETOTH cohort appear to be G.I. Bill eligible. While their MENTLGRP and CHYEC do not appear to differ from the NF/AEF cohorts, it would appear that these persons opted for shorter enlistment programs in oder to take advantage of the educational benefits. This might lead one to postulate that this form of educational benefit has a significant effect only when relatively short first term enlistments are required. The portion assumed to be G.I. Bill eligible in the ETOTH cohort coincides with the portion who separated at the first opportunity. This would tend to confirm the widely held belief that educational benefits tend to encourage separation from the service. This particular area, especially with the data available as the entire cohort ages, should provide a fruitful source for further analysis on this controversial subject.

The differences in ENTRY PAYGRADE between the different cohorts are clearly demonstrated. The small percentage recorded as having entered at paygrade E-1 in both NF and AEF programs attests to the presumption that these are errors. A quick comparison with the MNTHSE4 should elicit the relative differences in advancement criteria. Finally, the variable SEPCD seems to back up the presumption that higher Mental group categories and educational attainment support low attrition rates (less than 8% overall).

D. INDEPENDENT VARIABLES

The stepdisc procedure was standardized for all cohort analysis in one program illustrated in Appendix D. The choice of entry variables centered on ready availability and utility to the potential user. The most obvious choice was to begin with those already in use by the Recruiting Command, in the form of the "screen table". This table consists of scores based upon age, AFQT score, marital status and years of education. Additional characteristics available in the data set and thought to be of meaning to the analysis were: (1) Was a waiver required by the enlistee?; (2) What is the effect of having dependent children?; (3) What is the effect of entry paygrade on performance during enlistment?

While NF/AEF enlistees are supposed to enter at paygrade E-3, (this should not be a "variable" at all for these cohorts), the Navy offers other enlistees the opportunity to enter at paygrades higher than E-1. Policies which offer enhanced entry paygrade levels include: (a) lateral entry from the civilian community by a person already having the skills of a particular rating; (b) credit for specified periods of vocational training or college education; or (c) credit for referring persons who eventually enlist in the Navy. Accordingly, the following variables were selected for entry into the stepdisc function for all cohort groups:

WAIVER (0,1), MNTHSDEP, CHYEC, ENTRYAGE, ENTRPAYG
MRTSTAT1, DEPEND, all ASVAB subtests.

Variables like SCREEN, AFQT or MNTLGRP were not selected because they are already used to determine entrance requirements. It was felt that a more precise use of their components would ultimately be more useful, both practically and analytically. It was further recognized that, inherently, MRTSTAT1 and DEPEND should be highly intercorrelated. The intent in including both was to elicit the effect of additional dependents on enlistees at their entry age. Should total number of dependents indicate greater significance than marital status, the latter would be eliminated from the follow up analysis.

1. Correlations

As expected, the total sample correlation between DEPEND and MRTSTAT1 was positive and quite high, .8812, in this cohort. Neither variable, however, exhibited any significant correlation with any other. As discussed earlier, CHYEC and ENTRYAGE were positively correlated at a value of .5319. Neither one of these variables exhibited any other significant correlation with another. There was also a moderately strong relationship (.5184) between two ASVAB subtest scores, (SI) and (AI). This is not entirely unexpected as these subtests have been combined in later editions of the ASVAB (8, 9, 10) into one subtest (AS) designed to elicit auto and shop backgrounds. Collinearity, then, was not adjudged to present any particular analytic problems in the stepwise discriminant analysis.

2. Criterion Determination

The determination of meaningful criteria for success or failure of an enlistment is by far the most complex and difficult task. It requires a good deal of insight and awareness of Navy policies, especially regarding advancement opportunity, the training pipeline and judgement. For example, total promotions superficially seems to correlate positively with achievement in the Navy. However, a member demoted twice has the opportunity over a six year enlistment, to recoup his former rate. This will be reflected in a greater number of total promotions in the data set. This can be converted, if desired, into a "Net Promotions" variable, or discarded in favor of clearer, more precise measurements.

The strategy employed to determine criteria can be summarized as follows:

(1) Each cohort would be treated separately (NF, AEF and Others).

(2) An attempt would be made to develop categories or classifications of equal size to overcome or ameliorate problems of statistical bias left to chance. This meant that judgemental considerations on levels of performance measures would most likely be a major determinant of the model.

(3) Initial extreme criteria of "best" and "worst" measures would be developed as a starting point, leaving a large average group in the middle.

(4) The average group would be analyzed further to obtain more finite measures of "better" or "worse".

(5) This process would be repeated until either a meaningful model could be developed, or further refinement of criteria measures was deemed futile.

III. ANALYSIS OF COHORTS

A. NUCLEAR FIELD ENLISTEES (ETNF)

1. Initial Criteria

The most obvious measure of "good" was successful completion of the NF training pipeline. This is reflected in the data set by achievement of a nuclear qualified NEC as follows:

(DMDCNEC GE 3322) and (DMDCNEC LE 3389)

This group was assigned "Category 1" and the rest of the ETNF cohort was assigned Category 2 (the "worst", currently). This was entered into the stepdisc procedure utilizing the aforementioned entry variables.

The mean variable values for each specified category in this cohort can be found in Appendix E. Approximately half of the original enlistment cohort attained nuclear NECs. It was extremely interesting to note that in all variable categories, the means of the "successful" group were superior to the other group. Category 1 means were lower in the WAIVER variable, indicating fewer waivers were required for this group. Surprisingly, more of Category 1 observations indicated marriage than Category 2. The successful group was significantly older and had slightly more education, although both categories averaged more than

a high school education. It also appears that fewer "mistakes" were made regarding the entry paygrade status of Category 1 personnel than 2.

It was evident that further refinement of categories was going to be necessary. Despite the attainment of nuclear qualification, an individual must still maintain acceptable performance standards. Accordingly, the analysis was not carried to the regression procedure (REG) at this point in time. Instead, further refinement of the categories was indicated.

The logical measure of "bad" consisted of those variables which provided indications of unsuitable military behavior (AWOL, desertions, attritions, etc.). Accordingly, a "worst" category was developed which took into account these negative variables as follows:

If ((SEPCD EQ 2) or (NOTRCMD EQ 1) or (TOTLAWOL NE 0) or (TOTLDEMO NE 0) or (TOTDESRT NE 0)

This included all attritions for disciplinary reasons, all those not recommended for reenlistment, all those reduced in rate, and all those who had either deserted or gone AWOL for any period. While the author recognizes that many sailors begin very productive careers with a major disciplinary infraction, it is, nevertheless, an undesirable performance measure.

Accordingly, three categories were developed: (1) comprising nuclear qualified; (2) comprising those who

were dropped from the NF training pipeline; and (3) comprising all those with negative military performance variables. These were then entered into the stepdisc procedure.

During the iterations of this procedure, a programming idiosyncracy was discovered. When a category is defined, it is possible to inadvertantly recapture observations from this category into other categories. Either care must be taken to begin with broader categories, or specific criteria in opposition to those established in the first criteria must be specified. In the preceding example, if Category 3 was specified first, all of the nuclear trained personnel who had negative performance variables would have been recouped into Category 1, unless care was taken to include only those with "SEPCD NE 2", etc.

The differentiation between class means of the different variables proved interesting (see Appendix E). One would hope that Category 1 would have "better" values than Categories 2 or 3 in all variables as in the first step. However, most of the ASVAB subtest variable values in Category 3 (the worst) were higher than those in 2. On the other hand, MRTSTAT1, DEPEND, ENTRYAGE, CHYEC, and ASVAB (SI) followed the logical progression from top to bottom category. The most significant variable, and the first to be entered in the stepwise process, was MRTSTAT1. After completing all steps, the stepdisc process indicated that the variables indicated in Table V should be entered into the discriminant model:

TABLE V

Stepdisc Variables to Enter Model

	VARIABLE	R**2	F STATISTIC
1	MRTSTAT 1	0.0285	23.716
2	ASVABMK	0.0210	17.348
3	ASVABMC	0.0136	11.098
4	ENTRYAGE	0.0069	5.567
5	WAIVER	0.0078	6.346
6	MNTHSDEP	0.0052	4.207
7	ENTRPAYG	0.0048	3.888
8	ASVABAI	0.0039	3.121
9	ASVABAD	0.0029	2.326

The results of the regression process are illustrated in Table VI below.

The "Parameter Estimates" in TAble VI are coefficient values for the applicable variable in the regression equation. These variables were entered into the REG procedure and, as expected, indicated that two of the variables should be rejected. These were ASVAB (MK) and (MC), which elicited student t's with associated statistical significance of p = .18 and p = .25 respectively. The significance level means, e.g., that the probability of the population value of this parameter (ASVABMK) being equal to 0.0 is .18. The conventionally accepted level of significance is p = .05; accordingly, these two variables were discarded from the model, and the REG procedure was run again. The first REG procedure also indicated that ENTRPAYG was a significant

TABLE VI

Regression Results, 3 Categories

VARIABLE	PARAMETER EST	"T"	PROB > T
INTERCEPT	4.26437	10.866	0.0001
MRTSTAT1	-0.257263	-6.572	0.0001
ASVABMK	-0.019009	-1.333	0.1827
ASVABMC	-0.00943073	-1.140	0.2543
ENTRYAGE	-0.039424	-3.541	0.0004
WAIVER	0.126966	2.681	0.0074
MNTHSDEP	-0.014598	-2.323	0.0203
ENTRPAYG	-0.155294	-2.461	0.0139
ASVABAI	-0.016839	-2.770	0.0057
ASVABAD	-0.010222	-2.093	0.0365

STANDARDIZED B VALUES

INTERCEPT	0
ASVABAI	-0.07463559
MNTHSDEP	-0.05898860
MRTSTAT1	-0.15626793
ASVABMK	-0.03200244
ASVABMC	-0.03004443
ENTRPAYG	-0.05827556
ASVABAD	-0.04988171
ENTRYAGE	0.09163355
WAIVER	0.06488698

F = 11.20 PROB > F = .0001 R-SQUARE = .056

variable in the proposed model (p = .0139). As indicated earlier, this variable should not be required for the analysis, but it was left in to see if this apparent "mistake" happened to certain categories of people, or demonstrated

some degree of significance. The standardized beta values are included to illustrate the relative impact of each variable on the model. ENTRYAGE, MRTSTAT1 and ASVABAI have the most impact. The F statistic for the model is 11.20, significant at p = .0001 and the R-square is .056.

What does the model tell us? In the first place, WAIVER is a significant variable in the model, and in opposition to the others. That is, it has a "negative" effect on "good" categories. This is both logical and reasonable, especially if one recognizes that this variable's inclusion in the model attests to both a difficult recruiting environment and the credibility of Navy applicant screening standards. Secondly, the two most significant variables are what might be termed "maturity" variables (marriage and age), again a reasonable conclusion considering the categories. Lastly, the R-square is only .056, a level considered to be quite low. As mentioned earlier, a high R-square was not the major objective of this analysis, and I would be surprised, considering the sample sizes and the complexity of the observational environment, if an R-square of 10% could be achieved. The model is quite significant in terms of the F statistic (p = .0001).

The variables confirmed by the regression were then processed through the DISCRIM procedure.

Table VII demonstrates the test of the model.

The test methodology when three categories are used varies from that applicable to two categories. Table VII

TABLE VII

Discriminant Model Test Results

CALIBRATION SAMPLE

FROM CATEGORY	1	2	TOTAL
1	325	218	543
	59.85	40.15	100.00
2	168	233	401
	41.90	58.10	100.00
TOTAL	493	451	944
PERCENT	52.22	47.78	100.00

RANDOM SAMPLE

FROM CATEGORY	1	2	TOTAL
3	176	235	411
	42.82	57.18	100.00
TOTAL	176	235	411
PERCENT	42.82	57.18	100.0

illustrates a calibration sample developed from two categories. A random sample is then extracted from the third category, and the model is applied. The objective is to see how this random sample is distributed between the initial two categories.

In this case, the "hit" rate for the calibration sample was 59.85% and 58.1% for categories 1 and 2, respectively. However, when the sample from Category 3 (the worst) was applied to the model, 42.8% were placed in Category 1. This constitutes a "miss" rate, and resulted in further refinement of the criteria.

2. Development of Final Two Category Model

The general methodology employed in the development of a more sophisticated two category model consisted of: (1) defining specific categories of "better" or "worse", without limiting their numbers; and (2) combining these categories into two groups.

It seemed apparent that, because of the "bottom third rule" employed in the NF "A" school, the caliber of trainee was a secondary consideration. As long as a policy exists to excise the lower third without regard to an objective academic grading system, it seems inappropriate to label this group as "bad" without providing them with an opportunity for future assessment. It would be apparent, later on, if the experience of not surviving the nuclear training regimen acted as a demotivating factor demonstrated by less than optimum levels of future performance. However, since the lost time to recoup the portions of the conventional AEF-ET "A" school is minimal, even their advancement potential is not significantly affected.

Accordingly, it seemed evident that some measure of acceptable of unacceptable advancement criteria should be developed. Given that advancement to E-4 is automatic and takes place within one year of active duty for 90% of this cohort, it seemed inexcusable for an ET to not advance beyond this paygrade. The 10% who take longer to advance to E-4 can be delayed by a variety of factors, some of which are beyond their control. In our data set, time to E-4 is

most significantly affected by demotions. In the real world, illness, emergency leave and academic factors may delay a trainee's advancement opportunity significantly, especially considering the relative inflexibility of course schedules. It was decided, then, to include these advancement factors in the criteria as follows:

```
IF ((DMDCNEC GE 3322) AND (DMDCNEC LE 3389))
THEN CATEGORY=1;
IF ((DMDCNEC GE 0000) AND (DMDCNEC LE 2353))
THEN CATEGORY=2;
IF ((SEPCD EQ 2) OR (NOTRCMD EQ 1) OR (TOTLAWOL NE
0) OR (TOTIDEMO NE 0) OR (TOTDESRT NE 0) OR
(HYPAYGRD LE 4) OR (MNTHSE4 GT 0100)) THEN
CATEGORY=3;
IF (CATEGORY EQ 1) THEN CATEGORY=1;
IF (CATEGORY EQ 2) THEN CATEGORY=1;
IF (CATEGORY EQ 3) THEN CATEGORY=2;
```

This effectively placed all observations who had not advanced beyond E-4 or who took longer than one year to get to E-4, in the "worst" category. The method for combining categories is also illustrated.

The model was then processed through the stepdisc procedure as before. Category 1 had more favorable means in every area (Appendix E). All ASVAB subtests scores are

higher, they are older, have more education and tend to be married with an additional dependent. They tend to spend a bit longer in the DEP program and have less of a tendency to require waivers to enlist than category 2. From a relative standpoint, the two categories seem to be reasonably defined. In the first step of the stepdisc procedure, the variable DEPEND was selected as being the most significant with an F statistic of 72.907 ($p < .0001$). As might be expected, the variable MRTSTAT1 was close behind with an F value of 71.414, but DEPEND was placed into the model at this point. Table VIII illustrates the stepwise summary of variables selected for the model.

TABLE VIII

Stepwise Summary of Variables Selected--2 Categories

	STEPWISE SELECTION: SUMMARY		
	VARIABLE	R**2	F STATISTIC
1	DEPEND	0.0429	72.907
2	ENTRYAGE	0.0076	12.408
3	MNTHSDEP	0.0059	9.700
4	WAIVER	0.0033	5.428
5	ASVABAI	0.0031	4.988
6	MRTSTAT1	0.0027	4.464

These variables were then processed through the REG procedure to determine if they passed the t test. These results are indicated in Table IX.

TABLE IX

Results of REG--2 Categories

R-SQUARE	0.0667	F = 23.729
ADJ R-SQ	0.0629	p = .0001

VARIABLE	PARAMETER EST	"T"	PROB > T
INTERCEPT	2.607905	14.602	0.0001
METSTAT1	-0.079421	-1.585	0.1131
DEPEND	-0.086589	-2.498	0.0126
ENTRYAGE	-0.030671	-4.498	0.0001
WAIVER	0.073476	2.537	0.0113
MNTHSDEP	-0.010454	-2.740	0.0062
ENTRPAYG	-0.073948	-1.896	0.0581
ABSVABAI	-0.010008	-3.000	0.0027

As can be seen, two variables are of questionable significance in the REG model t tests: ASVABMC and ENTRPAYG. In view of the latter's relative lack of utility in this cohort, it was dropped from the model. Membership was then regressed on the remaining variables. The models' R-square was reduced slightly to .0634, the F statistic, 23.729 (p .0001). These variables were then processed through the DISCRIM procedure with the following results (as shown in Table X):

TABLE X

Results of DISCRIM--2 Categories

CALIBRATION SAMPLE

FROM CATEGORY	1	2	TOTAL
1	392	349	741
	52.90	47.10	100.00
2	158	326	484
	32.64	67.36	100.00
TOTAL	556	681	1237
PERCENT	44.95	55.05	100.00

RANDOM SAMPLE

FROM CATEGORY	1	2	TOTAL
1	163	147	310
	52.58	47.42	100.00
2	70	155	225
	31.11	68.89	100.00
TOTAL	236	303	539
PERCENT	43.78	56.22	100.00

The results of this DISCRIM procedure were quite different from the previous iteration. The total number of observations used in the DISCRIM procedure was 1225, 741 of which were in Category 1. The model is less acceptable in terms of Category 1 prediction credibility than the first DISCRIM results. However, it is a significantly improved model for Category 2. The model has a "hit" rate for Category 2 of 67.36% and a miss rate of 32.64%. On the test sample of 225 observations, it performs slightly better, with rates of 68.89% and 31.11% respectively.

The implications of this are most encouraging. Rather than predicting whether one will succeed or fail, the model's greatest value appears to be solely in terms of failure. For a user, this can be extremely valuable. If faced with two applicants, he might now be able to say that "because of this, this and that, you are more likely to fail in the nuclear program than the other guy."

As this model seemed to have sufficient potential user utility and credibility to the author, it was not pursued further. Additionally, the question of realistic criteria must be addressed. The criteria chosen are considered quite reasonable. As mentioned in chapter one, the accelerated advancement programs tend to promote six year enlistees extremely rapidly. However, this is not perceived to be in the best long-term interests of the Navy. Accordingly, while criteria could be readily developed to separate those personnel who do advance in minimum time, it does not necessarily follow that these are the people the Navy really wants. The ability to determine potential failure might be considered a more valuable tool in determining enlistment standards. It should also be noted that this model should apply only to personnel who can successfully pass the Navy's existing screening standards for the nuclear field program. This is the cohort from which it was developed and the only one to which it should apply at this stage of the analysis. The

ASVABAI subtest is not one used by the Navy, and it has since been replaced with a combined auto/shop information subtest in later test series. The new subtest's ability to act as a proxy for the old has not been tested here. This detracts from the model's utility. We see indications of a relatively less mature nuclear qualified enlistee, married without the additional responsibility (1.28 DEPEND), of dependent children, probably not needing a waiver, and with a slightly lower ASVABAI score as the profile of the unsuccessful nuclear field enlistee.

B. ADVANCED ELECTRONICS FIELD (AEF) COHORT

1. Initial Approach

After the analysis of the NF cohort, it was felt that the AEF cohort could be approached in much the same way. Both cohorts have similar qualifications for entry, significant numbers of nuclear trained personnel result from each, and opportunities for advancement are virtually identical. Accordingly, the initial approach, theoretically, could begin where the NF cohort ended. A decision was made to develop the same three categories for the AEF cohort and check to see if further refinements would be necessary. This was accomplished using the same criteria entered into the stepdisc function. The class means for all categories specified in this cohort are found in Appendix F.

The means of these categories are interesting when compared to that found in those of the ET-NF cohort. In the

AEF cohort, MRTSTAT1, CHYEC and eight of the ASVAB subtest mean scores descend in a manner consistent with the way the categories are set up (best to worst). This is not the case for the variables ENTRYAGE, WAIVER, MNTHSDEP, and DEPEND. It is odd that DEPEND and MRTSTAT1 seem to have different effects on the three categories.

Rather than continue the three category analysis, it was decided to convert these into a two category group in the same manner that the ET-NF cohort was treated. These two categories were then processed through the stepdisc procedure. Category 1 means were higher than 2 in all variables except WAIVER and ENTRPAYG. Compared to the three category "inversions" that occurred previously, this was most encouraging. It is obvious that the numbers and quality of the category 1 group, those who became nuclear qualified, were sufficiently powerful to overcome the "average" conventional AEF group in the cohort. The variables selected by the stepwise discriminant analysis are illustrated in Table XI.

As we can see, the variable DEPEND was the most significant input to the model. This is also the first time the ASVAB subtest EI has demonstrated any degree of significance. Where ASVABAI was found to be an important discriminator with the NF cohort, its complement, ASVABSI, shows significance in the AEF cohort. These variables were then processed through the REG procedure to confirm their contributions to the model.

TABLE XI

Stepdisc Summary of Input Variables--2 Categories

VARIABLE	NUMBER IN	PARTIAL R**2	F STATISTIC	PROB > F
DEPEND	1	0.0189	39.366	0.0001
ASVABEI	2	0.0134	27.646	0.0001
MNTHSDEP	3	0.0071	14.579	0.0001
ENTRYAGE	4	0.0061	12.433	0.0004
ASVABSI	5	0.0019	3.870	0.0493

In the regression analysis, all variables demonstrated t significance better than .10. ASVABSI, at .087, was considered marginal. Accordingly, it was decided to conduct the discriminant analysis twice to see if ASVABSI contributed significantly to the model. The R-square for the model was .0433, and the F statistic was 21.929, ($p < .0001$). Table XII illustrates the standardized beta weights (coefficients) developed by the regression procedure.

TABLE XII

Standardized B Values--AEF Variables

	STANDARDIZED B VALUES
ASVABEI	- 0.07577879
MNTHSDEP	- 0.09350627
DEPEND	- 0.15214210
ASVABNO	- 0.05073859
ENTRYAGE	- 0.04830051
ASVABSI	- 0.03413207

As can be readily seen from Table XII, the most significant variable to the model is DEPEND. ASVABSI has the least impact. All six variables were then processed through the DISCRIM procedure.

The DISCRIM procedure utilized 1955 observations, 1097 of which were in Category 1 (56%). Table XIII illustrates the pertinent results.

The "hit rates" resulting from the DISCRIM procedure were encouraging. In the calibration sample, the model selected 55.2% of Category 1 observations and placed them in Category 1. However, the model demonstrated a "hit" rate of 60.14% in Category 2. This was somewhat surprising to the author because of the distribution of the calibration observations. With 56% of the calibration observations in Category 1, it was expected that a similar proportion, (or better) would have been developed by the model. The results for Category 1 were fairly consistent with this hypothesis. However, the results for Category 2 far exceeded expectations. The "hit" rate was about 16% above the chance distribution.

In the random sample test, the "hit" rate for Category 1 decreased slightly. However, the "hit" rate for Category 2 increased to 63.38%. While an increase in the probability of assessing success of only 5% may not be significant, an increase of over 10% offers some hope for utility in anticipating future failure.

The model was processed once again through the DISCRIM procedure, deleting ASVABSI. This effectively

TABLE XIII

Results of Discriminant Analysis--AEF 6 Variables

	CATEGORY	
	1	2
CONSTANT	-89.49128765	-85.64771994
ASVABEI	1.87276124	1.82556990
ENTRYAGE	3.82501943	3.77901758
DEPEND	1.18482722	0.75860692
ASVABSI	1.37751830	1.34831644
ASVABNO	0.72489031	0.71422331
MNTHSDEP	1.33444421	1.27135089

CALIBRATION SAMPLE

FROM CATEGORY	1	2	TOTAL
.	3	5	8
	37.50	62.50	100.00
1	606	491	1097
	55.24	44.76	100.00
2	342	516	858
	39.86	60.14	100.00
TOTAL	951	1012	1963
PERCENT	48.45	51.55	100.00
PRIORS	0.5000	0.5000	

RANDOM SAMPLE

FROM CATEGORY	1	2	TOTAL
.	3	1	4
	75.00	25.00	100.00
1	291	241	532
	54.70	45.30	100.00
2	156	270	426
	36.62	63.38	100.00
TOTAL	450	512	962
PERCENT	46.78	53.22	100.00

increased the calibration sample size to 2040 observations, (the effect of missing values of the variable ASVABSI), 57.4% (1172) of which were in Category 1. Table XIV shows the model's "hit" rates on each category.

TABLE XIV

Discriminant Results--AEF 5 Variables

CALIBRATION SAMPLE

FROM CATEGORY	1	2	TOTAL
.	4	4	8
	50.00	50.00	100.00
1	651	521	1172
	55.55	44.45	100.00
2	339	529	868
	39.06	60.94	100.00
TOTAL	994	1054	2048
PERCENT	48.54	51.46	100.00
PRIORS	0.5000	0.5000	

RANDOM SAMPLE

FROM CATEGORY	1	2	TOTAL
.	3	2	5
	60.00	40.00	100.00
1	288	217	505
	57.03	42.97	100.00
2	159	284	443
	35.89	64.11	100.00
TOTAL	450	503	953
PERCENT	47.22	52.78	100.00

Both "hit" rates improved slightly without ASVABSI, without adversely affecting the F significance of .0001.

This is considered extremely important because ASVABSI is not longer administered. The model's greatest value, in this cohort, as well as the NF cohort, is in its potential for predicting failure rather than success.

C. OTHER ENLISTEES (ETOTH)

1. General

It was recognized that the development of criteria for the ETOTH cohort had to differ from the six year enlistee cohorts. Firstly, the majority of these personnel do not have the advancement opportunity of the NF/AEF cohorts. As a rule, they enter at paygrade E-1 and have to work their way up through the entire Navy advancement process. Secondly, as qualified as these enlistees may be in terms of mental group category, their enlistments in programs other than the six year programs suggest different motivating factors. These might include: (1) GI Bill eligibility; (2) Guarantees of location such as coast of choice; or (3) merely wanting to give the Navy a try and developing an interest in, and striking for the ET rating. From the data set, it appears that approximately one-third (349) of the ETOTH cohort shifted into either the NF or AEF programs after they entered the service. This was elicited from the data by examining the variable NDAYSE3 equals 0.

A final factor in determining ETOTH criteria was the inclusion of data from the Navy Examining Center. Applicable only to advancement to paygrade E-4, the ETOTH

group was the only cohort which contained sufficient numbers of observations from advancement data. The major advantage of this data is that it includes the variable PRFFACTR. This is a measure of assessment of an individual's overall performance as an E-3, submitted by his Commanding Officer. This variable is the only source known to the author from which a fleet assessment of an individual at paygrade E-3 is readily available. For manpower analyses of junior, first term personnel, this data set provides a unique opportunity to incorporate the Navy's evaluation system.

2. Initial Approach

It was decided initially to separate the ETOTH cohort into broad categories to obtain a better insight into its composition. These broad categories were: (1) nuclear qualified; (2) conventional ET's; (3) participants in the E-4 advancement examination; and (4) those with negative performance characteristics. This was accomplished through the use of the following algorithm:

```
IF ((DMDCNEC GE 3322) AND (DMDCNEC LE 3389)) THEN
CATEGORY = 1; IF ((DMDCNEC GE 0000) AND (DMDCNEC LE
2353)) THEN CATEGORY = 2; IF (EXAMRATE EQ 1000) THEN
CATEGORY = 3; IF ((SEPCD EQ 2) OR (NOTRCMD EQ 1) OR
(TOTALWOL NE 0) OR (TOTLDEMO NE 0) OR (TOTDESRT NE
0)) THEN CATEGORY = 4;
```

This resulted in the following distribution of the ETOTH cohort:

Cat 1: N = 86 Cat 2: N = 146 Cat 3: N = 206

Cat 4: N = 141

These four categories were then processed against the complete set of input variables for purposes of comparison. Results are found in Appendix G. In general, the mean values assigned to variables in Categories 1 and 2 were higher, or more favorable than those in the bottom two categories. It was interesting to note that only in Category 3 was the mean CHYEC less than 12. This is indicative of personnel who "work their way up" in the fleet without benefit of formal Navy training.

It is also worthwhile noting that the total number of classifiable observations was only 579, a considerable drop from the cohort size of 1101. This is due entirely to the construction of missing values in the SAS data set because of erroneous or unreasonable variable values in the source data tapes. While missing values occurred in all cohorts, almost one-half of this cohort was lost. It might be possible that the extensive screening process for NF and AEF programs in the Recruiting Command leads to better documentation of enlistment data. The ETOTH cohort, unfortunately, experienced poor documentation.

In order to develop further criteria which could be compressed into two distinct "better" or "worse" groups, it seemed evident that some assessment of Category 3 observations was going to be necessary. The author used two somewhat

arbitrary means to accomplish this. These were based on the insight gained through nineteen years of active Naval service, and an investigation of the frequency distribution of the variable PRFFACTR. The former gives one an appreciation for the inflation that pervades the Navy's evaluation system. The "average" sailor is often thought of in terms of "3.0" on a 4.0 scale. The author's experience, however, indicates that the "average" sailor is closer to "3.4" or "3.6". A grade of less than "3.0" assigned to any one of the five traits evaluated on non-rated personnel, is considered, if not adverse, at least negative. Hence, there exists a tendency to shift grades upwards in order to discriminate between traits without assigning negative grades. The frequency distribution for Category 3 observations indicated that 65% of examination participants had overall performance evaluations greater than "3.5". Accordingly, this value was determined as a reasonable cut-off criterion to separate this category.

The two categories were developed through the following algorithm:

```
IF ((DMDCNEC GE 3322) AND (DMDCNEC LE 3389)) THEN
CATEGORY = 1;
IF ((DMDCNEC GE 0000) AND (DMDCNEC LE 2353)) THEN
CATEGORY = 2;
IF ((EXAMRATE EQ 1000) AND (PRFFACTR GE 350)) THEN
CATEGORY = 3;
```

```
IF ((EXAMRATE EQ 1000) AND (PRFFACTR LT 350)) THEN
CATEGORY = 4;
IF ((SEPCD EQ 2) OR (NOTRCMD EQ 1) OR (TOTLAWOL NE
0) OR (TOTLDEMO NE 0) OR (TOTDESRT NE 0)) THEN.
CATEGORY = 5;
IF (CATEGORY EQ 1) THEN CATEGORY = 1;
IF (CATEGORY EQ 2) THEN CATEGORY = 1;
IF (CATEGORY EQ 3) THEN CATEGORY = 1;
IF (CATEGORY EQ 4) THEN CATEGORY = 2;
IF (CATEGORY EQ 5) THEN CATEGORY = 2;
```

Table XV indicates the variables selected by the stepdisc procedure for entry into the discriminant analysis.

TABLE XV

STEPDISC Summary Variables, 2 Categories

VARIABLE	NUMBER	PARTIAL R**2	F STATISTIC	PROB > F
MRTSTAT 1	1	0.0288	17.141	0.0001
MNTHSDEP	2	0.0241	14.196	0.0002
ASVABMK	3	0.0131	7.604	0.0060
ENTRYAGE	4	0.0098	5.698	0.0173
WAIVER	5	0.0104	6.003	0.0146

The class means (Appendix G) demonstrate that Category 1 is higher in all variables except four ASVAB subtests. Category 2 has a mean educational level below 12 years, a rarity in this rating. Of the 579 observations that could

be included in the analysis, 380 (66%) were in Category 1. The variables to be entered into the model are similar to those of the other cohorts, with the addition of ASVABMK, the first time this variable has demonstrated a degree of significance. F statistics are all significant at the .0173 level or less.

Processing through the REG procedure produced the pertinent results contained in Table XVI.

TABLE XVI

Results of REG-ETOTH, 2 Categories

F = 13.64 Prob > F = .0001 r-square = .0821

STANDARDIZED B VALUES

ASVABMK	-0.10192134
MNTHSDEP	-0.14653371
MRTSTAT1	-0.17023905
ENTRYAGE	-0.09976211
WAIVER	0.10298195

The r-square was the highest experienced in the investigation. MRTSTAT1 and MNTHSDEP were indicated as the most significant variables in the model. All t statistics were significant at .0050 or less. These variables were then processed through the DISCRIM procedure, which resulted in 534 observations, 67% of which were in Category 1. The significant results from this process are demonstrated in Table XVII.

TABLE XVII

DISCRIM Results--ETOTH, 2 Categories

CALIBRATION SAMPLE

FROM CATEGORY	1	2	TOTAL
.	4	4	8
	50.00	50.00	100.00
1	223	135	358
	62.29	37.71	100.00
2	68	108	176
	38.64	61.36	100.00
TOTAL	295	247	542
PERCENT	54.43	45.57	100.00
PRIORS	0.5000	0.5000	

RANDOM SAMPLE

FROM CATEGORY	1	2	TOTAL
.	1	1	2
	50.00	50.00	100.00
1	83	61	144
	57.64	42.36	100.00
2	35	55	90
	38.89	61.11	100.00
TOTAL	119	117	236
PERCENT	50.42	49.58	100.00
PRIORS	0.5000	0.5000	

The "hit" rates of this model are better than those experienced in the NF/AEF cohorts. From the calibration sample, 62.29% and 61.36% are correctly categorized for 1 and 2 respectively. Although the random sample correctly picked only 57.64% for Category 1, it "hit" 61.11% for Category 2. Considering the chance distribution of

Category 2 (33%), this model demonstrated excellent improvement in predicting failure.

IV. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

1. General

Using similar criteria, three distinct models have been developed as predictors of ET enlistment performance. These are summarized in Table XVIII, and Appendix H.

TABLE XVIII

Summary of Models for Each Cohort, Variables

ETNF	ETAEF	ETOTH
MNTHSDEP	MNTHSDEP	MNTHSDEP
DEPEND	DEPEND	MRTSTAT1
ENTRYAGE	ENTRYAGE	ENTRYAGE
WAIVER	ASVABNO	WAIVER
ASVABAI	ASVABEI	ASVABMK

It is noteworthy that all models contain MNTHSDEP, ENTRYAGE, and either DEPEND or MRTSTAT1. Age and marriage are two fairly obvious measures of maturity. However, the significance of DEP participation was not anticipated. As discussed earlier, it connotes commitment and the idea of planning one's future. The DEP program in the Recruiting Command is also used as a vehicle for involvement for the prospective entrant, and perhaps this tends to improve his future performance. Regardless of the reasons behind its

significance, MNTHSDEP can probably be classified as a maturity variable as well. Two of the models elicited WAIVER as a significant variable. This was a binary variable developed in order to assess whether enlistees who required waivers to enlist in one of the recruiting programs, tended to be poorer performers. Two of the models indicate that this is true; most surprising to the author is that the ETOTH cohort is one of them. The priorities and stiff entrance requirements of the NF program probably generated a large number of waivers during this poor recruiting era. Poorer performance might be expected as this group tackles the NF training pipeline. The ETOTH group is a different matter. This group is comprised of enlistees who needed only the bare minimum requirements to enlist. Perhaps this is an indication that, if one needs a waiver to pass this hurdle, the ET rating should be avoided. The significance of the ASVABMK for the ETOTH cohort does make sense, because it is a requirement to enter the NF and AEF pipelines. If a third of the cohort shifted into these pipelines after enlisting, they probably had fairly high scores in this subtest, perhaps enough to make it significant in the model. There is neither rhyme nor reason for the two subtests (other than ASVABEI) being significant in the NF/AEF cohorts. Since neither subtest is part of the qualification for these programs, it seems reasonable that it gains significance because there is insufficient spread on the nine

subtests that are required. However, there is no intuitive explanation for the applicability of these two.

2. Use of the Models

The point should be emphasized that these three models are not general, but quite specific in their applications. They are developed from enlistees who, for the most part, have already passed rigorous screening criteria, and should not be applied unless the individual "passes" the appropriate screen. Hence, they are probably most useful in the RTC or BE&E courses where considerable effort is devoted toward re-routing recruits and trainees into programs where shortages exist.

Secondly, the models tend to be of more value in assessing chances of failure rather than success. If an individual falls into Category 1, for example, the applicable models, with the possible exception of the ETOTH, do not materially contribute to improving estimates of his future success. The models do, however, improve the odds of predicting failure for those personnel who fall in Category 2. For these personnel, the Navy can take essentially three courses of action: (1) It can minimize the training investment in this group by earlier attrition; (2) programs can be developed specifically designed to improve their chances of success; or (3) these personnel might be better of moving to another rating. The latter course seems the most reasonable option.

The heart of each model is the development of the criteria. It would have been fairly simple to develop extreme criteria designed to separate the "super achievers" from their opposites through methodologies to determine opportunity to advance to E-5 and above. However, the thrust of this research is not to identify the super sailor, but simply the good sailor. Accordingly the criteria have been developed with what are considered acceptable standards of performance. Should data on E-5 and E-6 advancements be made available in the data set, an opportunity to include Commanding Officers' judgements on the performance of these personnel would enhance the establishment of criteria.

B. RECOMMENDATIONS

The models do offer some potential for usefulness. Exactly how this would be implemented on a practical basis is another question altogether. ET's as a group have considerably higher qualifications than most ratings demand. Yet, it is the author's contention that we offer them limited opportunities for satisfying careers beyond their first enlistment. Their training and overall quality merits a strong look at improving their opportunities in the service, whether as ET's or in some other career field. Special Limited Duty or Warrant officer programs might be one option, but we must address the fundamental, long-term problems inherent in accelerated advancement programs.

This data base is unique in many respects. It offers, and can continue to offer limitless opportunities for worthwhile research and investigation as the cohort ages. This should be pursued, especially in ratings or skills the Navy experiences perennial manning shortages.

APPENDIX A

VARIABLES USED IN ANALYSIS

VARIABLE	DEFINITION
ASVABAI	ASVAB Automotive Information (20 items)
ASVABGS	ASVAB General Science (20 items)
ASVABSI	ASVAB Shop Information (20 items)
ASVABMC	ASVAB Mechanical Comprehension (20 items)
ASVABEI	ASVAB Electronics Information (30 items)
ASVABMK	ASVAB Mathematics Knowledge (20 items)
ASVABSP	ASVAB Space Perception (20 items)
ASVABAR	ASVAB Arithmetic Reasoning (20 items)
ASVABWK	ASVAB Word Knowledge (30 items)
ASVABAD	ASVAB Attention to Detail (30 items)
ASVABNO	ASVAB Numerical Operations (50 items)
ASVABGI	ASVAB General Information (15 items)
ENTRYAGE	Age of individual at time of entry
CHYEC	Highest year of education
WAIVER	Permit code for an otherwise ineligible (0 = not required; 1 = required)
MRTSTAT1	Marital Status (1, other; 2, married)
DEPEND	Number of Dependents (0, none; 1, one; 2, more than 1)
SEPCD	Service separation code (0, active duty; 1, honorable; 2, attrite)
SIGNUP	G.I. Bill Eligibility (if LE 7700)
MNTHSDEP	Months in Delayed Entry Program (D.E.P.)

EXAMRATE	Advancement examination rate code
EXRTABRV	Examination rate (abbreviation)
PRFFACTR	Performance Factor
TOTLDEMO	Total Demotions
TOTLAWOL	Total UA/AWOL
TOTDESRT	Total Desertions
LNGTHSRV	Total length of service
ATTRITCD	Attrition indicator (0, active duty; 1, honorable; 2, attrite)
RECPRGSC	Recruit Program/School code
RECPGSCRT	Recruit Program/School Rate code
NDAYSE2	Computed number of Days to E-2 rating
NDAYSE3	Computed number of Days to E-3 rating
NDAYSE4	Computed number of Days to E-4 rating
DMDCRATE	Final rating as listed by D.M.D.C.
DMDCNEC	Final N.E.C. as listed by D.M.D.C.

APPENDIX B

ADJUSTMENTS TO VARIABLE VALUES

```
IF (NDAYSE4 EQ 9999) THEN NDAYSE4=.;
IF (NDAYSE3 EQ 9999) THEN NDAYSE3=.;
IF (ENTRYAGE EQ 77) THEN ENTRYAGE=17;
IF (MRTSTAT1 EQ 0) THEN MRTSTAT1=1;
IF (NDPNDNT1 EQ 0) THEN NDPNDNT1=1;
IF (NDPNDNT1 EQ 1) THEN DEPEND=1;
IF (NDPNDNT1 EQ 2) THEN DEPEND=2;
IF (NDPNDNT1 GT 2) THEN DEPEND=3;
    NPPNDNT1=DEPEND;
IF (WAIVER EQ 0) THEN WAIVER=0;
IF (WAIVER EQ 9) THEN WAIVER=1;
IF (DMDCNEC EQ '10') THEN DMDCNEC='0001';
IF (DMDCNEC EQ '48M9') THEN DMDCNEC='0001';
IF (DMDCNEC EQ '91M9') THEN DMDCNEC='0001';
IF (DMDCNEC GE 3902) THEN DMDCNEC='0001';
IF ((ASVABGI GT 15) OR (ASVABGI LE 5)) THEN ASVABGI=.;
IF ((ASVABNO GT 50) OR (ASVABNO LE 21)) THEN ASVABNO=.;
IF ((ASVABAD GT 30) OR (ASVABAD LE 6)) THEN ASVABAD=.;
IF ((ASVABWK GT 30) OR (ASVABWK LE 18)) THEN ASVABWK=.;
IF ((ASVABAR GT 20) OR (ASVABAR LE 13)) THEN ASVABAR=.;
IF ((ASVABSP GT 20) OR (ASVABSP LE 6)) THEN ASVABSP=.;
IF ((ASVABMK GT 20) OR (ASVABMK LE 13)) THEN ASVABMK=.;
IF ((ASVABEI GT 30) OR (ASVABEI LE 14)) THEN ASVABEI=.;
```

```
IF ((ASVABMC GT 20) OR (ASVABMC LE 6)) THEN ASVABMC=.;
if 99asvabgs gt 20) OR (ASVABGS LE 9)) THEN ASVABGS=.;
IF ((ASVABSI GT 20) OR (ASVABSI LE 7)) THEN ASVABSI=.;
IF ((ASVABAI GT 20) OR (ASVABAI LE 5)) THEN ASVABAI=.;
IF HYEC=1 THEN CYEC=3.5;
IF HYEC=2 THEN CHYEC=8;
IF HYEC=3 THEN CHYEC=9;
IF HYEC=4 THEN CHYEC=10;
IF HYEC=5 THEN CHYEC=11;
IF HYEC=6 THEN CHYEC=12;
IF HYEC=7 THEN CHYEC=13;
IF HYEC=8 THEN CHYEC=14;
IF HYEC=9 THEN CHYEC=15;
IF HYEC=10 THEN CHEC=16;
IF HYEC=11 THEN CHYEC=18;
IF HYEC=12 THEN CHYEC=20;
IF HYEC=13 THEN CHYEC=11.5;
   HYEC=CHYEC;
IF (NDAYSE4 LE 240) THEN MNTHSE4='0008';
IF ((NDAYSE4 GE 241) AND (NDAYSE4 LE 270)) THEN
MNTHSE4='0009'; IF ((NDAYSE4 GE 271) AND (NDAYSE4 LE 300))
THEN MNTHSE4='0010'; IF ((NDAYSE4 GE 301) AND (NDAYSE4 LE
330)) THEN MNTHSE4='0011'; IF ((NDAYSE4 GE 331) AND (NDAYSE4
LE 360)) THEN MNTHSE4='0100'; if 99ndayse4 GE 361) AND
(NDAYSE4 LE 540)) THEN MNTHSE5='0106'; IF ((NDAYSE4 GE 541)
AND (NDAYSE4 LE 720)) THEN MNTHSE4='0200'; IF (NDAYSE4 GE
721) THEN MNTHSE4='0300';
```

```
  IF ((ISC3 GE 30) AND (ISC3 LE 42)) THEN SEPCD=.; IF ((ISC3
GE 1) AND (ISC3 LE 22)) THEN SEPCD=1;  IF ((ISC3 GE 60) AND
(ISC3 LE 87)) THEN SEPCD=2; IF (ISC3 GE 90) THEN SEPCD=1; IF
(ISC3 EQ 0) THEN SEPCD=0; ISC3=SEPCD;
            SIGNUP = ((BASD1YR * 100 + GASD1MTH) - MNTHSDEP);
```

APPENDIX C

PROGRAM USED TO DEVELOP INDIVIDUAL COHORTS

```
DATA FILEOUT.ETNF;   SET FILEIN.ETALL;   IF ((RECPRGSC GE
'23') AND (RECPRGSC LE '26'));
DATA FILEOUT.ETAEF;  SET FILEIN.ETALL;   IF ((RECPRGSC GE
'04') AND (RECPRGSC LE '12));
DATA FILEOUT.ETOTH;  SET FILEIN.ETALL;   IF ((RECPRGSC LE
'02')  AND (RECPRGSC EQ '31) AND (RECPRGSC EQ '34') AND
(RECPRGSC GE '43) AND (RECPRGSC LE '47') AND (RECPRGSC GE
'70') AND (RECPRGSC LE '73') AND (RECPRGSC EQ '-'));
```

APPENDIX D

PROGRAMS USED FOR SAS PROCEDURES

STEPWISE DISCRIMINANT

```
PROC STEPDISC SIMPLE STDMEAN TCORR WCORR;VAR WAIVER
ASVABGI--ASVABAI ENTRYAGE CHYEC MNTHSDEP MRTSTAT1 DEPEND
ENTRPAYG; CLASS CATEGORY;
```

```
    REGRESSION PROC SYSREG SIMPLE;  MODEL CATEGORY=
ASVABAI MNTHSDEP DEPEND
    ENTRYAGE WAIVER/STB;
```

DISCRIMINANT ANALYSIS

```
    RANDOM10=NORMAL(0):  IF((RANDOM10 GE -1) AND (RANDOM10 LE
1)) THEN DVSMPL10=1;
                                        ELSE DVSMPL10=0;
DATA DERIV8;SET  DATA1;IF DVSMPL10=1;  DATA VALID8; SET
DATA1;IF DVSMPL10=0;  PROC DISCRIM S POOL=YES DATA=DERIV8
OUT=CALIBR81;VAR
 ASVABMK ENTRYAGE MNTHSDEP MRTSTAT1
        MNTHSDEP; CLASS CATEGORY; PROC DISCRIM DATA=CALIFR81
TESTDATA=VALID8;TESTCLASS CATEGORY;
```

APPENDIX E

CLASS MEANS OF INPUT VARIABLES FOR ET-NF SPECIFIED CATEGORIES

ET-NF TWO CATEGORIES (first iteration)

	CLASS MEANS	
VARIABLE	1	2
WAIVER	0.19922	0.20571
ASVABGI	12.63672	12.32800
ASVABNO	41.02083	40.22743
ASVABAD	16.39714	15.95086
ASVABWK	27.51042	27.36457
ASVABAR	18.85417	18.61486
ASVABSP	16.43229	16.17143
ASVABMK	19.01042	18.76914
ASVABEI	25.56901	25.19086
ASVABMC	15.98828	15.40571
ASVABGS	17.10286	16.86057
ASVABSI	16.53385	16.26057
ASVABAI	15.17839	14.35429
ENTRYAGE	19.38411	19.10514
CHYEC	12.30924	12.29314
MNTHSDEP	2.91536	2.92114
MRTSTAT1	1.42318	1.27429
DEPEND	1.57031	1.36571

ET-NF THREE CATEGORIES

CLASS MEANS

VARIABLE	1	2	3
WAIVER	0.19586	0.17391	0.25824
ASVABGI	12.62483	12.28922	12.41484
ASVABNO	40.98207	40.06994	40.60714
ASVABAD	16.40138	16.00189	15.87637
ASVABWK	27.52966	27.30435	27.39835
ASVABAR	18.85103	18.53686	18.75549
ASVABSP	16.46621	16.10208	16.20879
ASVABMK	19.00690	18.60681	18.98626
ASVABEI	25.58724	25.03025	25.35440
ASVABMC	16.00000	15.18336	15.73352
ASVABGS	17.10897	16.72401	17.02473
ASVABSI	16.55172	16.26654	16.19231
ASVABAI	15.17931	14.31191	14.49176
ENTRYAGE	19.42345	19.10775	19.00824
CHYEC	12.31379	12.30435	12.25412
MNTHSDEP	2.83241	3.11153	2.60165
MRTSTA1	1.42897	1.30624	1.23352
DEPEND	1.58207	1.41021	1.29945
ENTRPAYG	2.97931	2.93762	2.93132

ET-NF FINAL CATEGORIES

CLASS MEANS

VARIABLE	1	2
WAIVER	0.18648	0.22734
ASVABGI	12.52869	12.37788
ASVABNO	40.73463	40.40092
ASVABAD	16.29713	15.92627
ASVABWK	27.49078	27.34716
ASVABAR	18.78791	18.63594
ASVABSP	16.33504	16.23502
ASVABMK	18.90676	18.82796
ASVABEI	25.47848	25.18587
ASVABMC	15.77049	15.53610
ASVABGS	16.99693	16.93088
ASVABSI	16.48566	16.23195
ASVABAI	14.96824	14.39939
ENTRYAGE	19.38730	18.98464
CHYEC	12.30789	12.27727
MNTHSDEP	3.00205	2.80492
MRTSTAT1	1.42316	1.22427
DEPEND	1.57787	1.28571

APPENDIX F

CLASS MEANS FOR CATEGORIES IN ET-AEF COHORT

	CLASS MEANS		
VARIABLE	1	2	3
WAIVER	0.19630	0.29139	0.2586
ASVABGI	12.09630	12.10486	11.8568
ASVAGNO	38.36296	38.13687	37.7067
ASVABAD	15.67778	15.55188	15.5265
ASVABWK	26.43333	26.21523	26.0265
ASVABAR	17.68519	17.56954	17.5843
ASVABSP	15.41852	15.71744	15.5427
ASVABMK	17.88519	17.58278	17.5334
ASVABEI	25.30370	25.18874	24.3845
ASVABMC	15.43704	15.20640	14.8614
ASVABGS	16.28519	15.78146	15.5889
ASVABSI	16.78889	16.89956	16.3660
ASVABAI	15.24815	15.15011	14.5369
ENTRYAGE	19.41111	19.65784	19.1651
CHYEC	12.12963	12.12914	12.0779
MNTHSDEP	3.90000	4.22185	3.7367
MRTSTAT1	1.44074	1.43929	1.3198
DEPEND	1.61852	1.63024	1.4203

APPENDIX G

CLASS MEANS ETOTH COHORT

'CLASS MEANS--ETOTH, 2 CATEGORIES'

VARIABLE	1	2
WAIVER	0.21842	0.32161
ASVABGI	12.17632	12.24623
ASVABNO	38.78947	37.56281
ASVABAD	15.65263	15.56281
ASVABWK	26.63684	26.45226
ASVAGAR	18.01053	17.70352
ASVABSP	15.47368	15.55276
ASVABMK	17.96316	17.50251
ASVABEI	24.70000	24.67337
ASVABMC	15.18684	14.98995
ASVABGS	16.14737	15.96985
ASVABSI	16.65789	16.70352
ASVABAI	14.99211	15.03015
ENTRYAGE	19.65526	19.22613
CHYEC	12.09868	11.89950
MNTHSDEP	2.41316	1.62312
MRTSTAT1	1.38947	1.22111

APPENDIX H

DISCRIMINANT COEFFICIENTS OF FINAL MODELS

	ET-NF	
	1	2
CONSTANT	-75.19458198	-71.37095983
DEPEND	1.60712310	1.00576875
ASVABAI	0.69398663	0.65568999
MNTHSDEP	1.68156224	1.63255214
ENTRYAGE	6.87631794	6.75452697
WAIVER	- 3.53860298	- 3.16016087

	ET-AEF CATEGORY	
	1	2
CONSTANT	-82.93737765	-79.31009908
ASVABEI	2.17503226	2.11656053
ENTRYAGE	3.85050035	3.80823947
DEPEND	1.56339049	1.15187896
ASVABNO	0.76093302	0.74753547
MNTHSDEP	1.31978444	1.26079914

	ET-OTH	
	1	2
CONSTANT	-83.24235027	-77.89398864
ASVABMK	5.37988382	5.19433941
ENTRYAGE	3.05505401	2.99590928
MNTHSDEP	0.85944213	0.72602070
MRTSTAT1	6.40478311	5.89708891
MNTHSDEP	0.00000000	0.00000000

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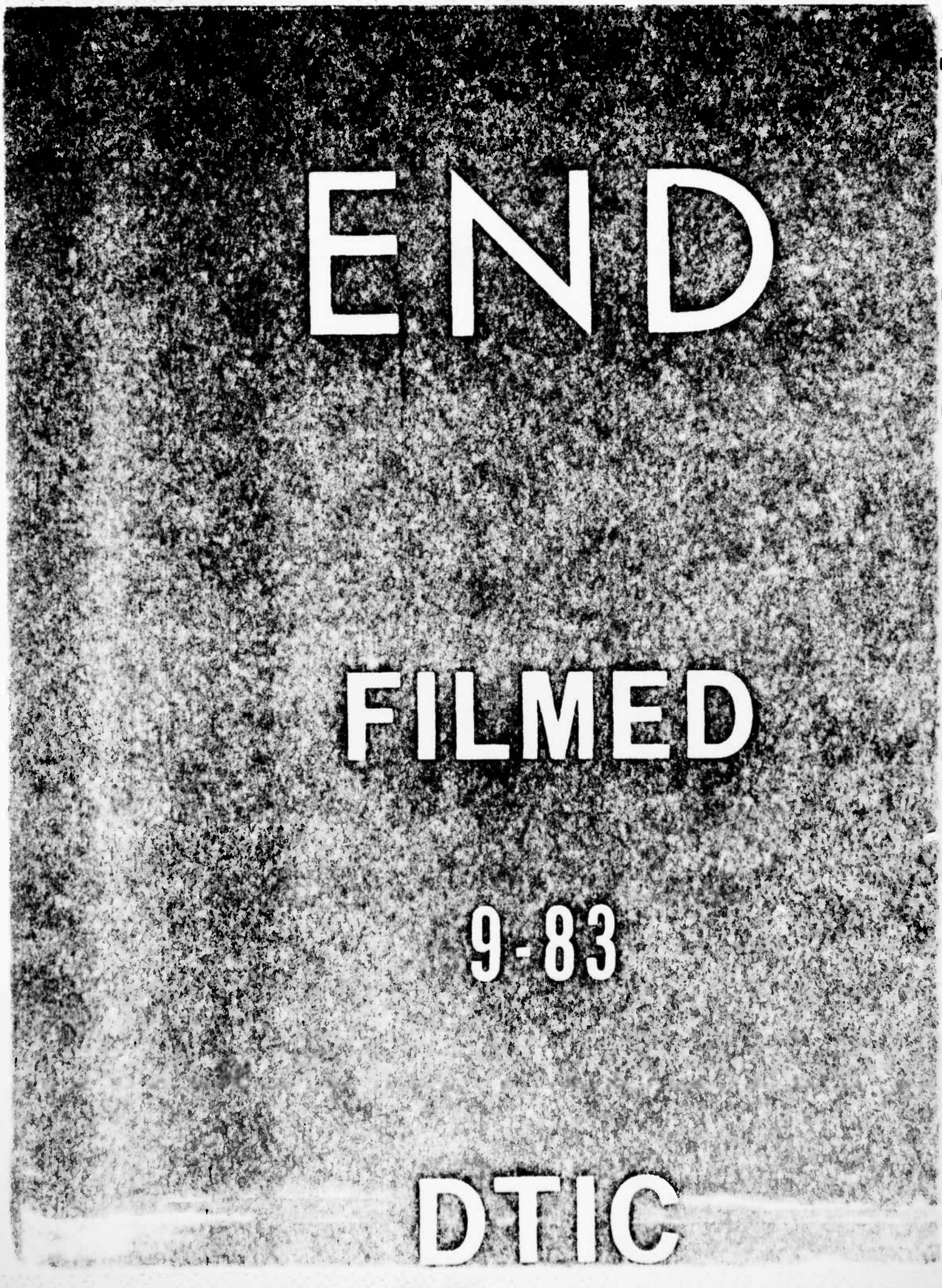
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